UNIVERSITY OF GEORGIA

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University Council

January 18, 2019

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Dear Colleagues:

The attached proposal from the AP Council to revise the AP Credit Policy for MATH 2260, Calculus II for Science and Engineering will be an agenda item for the January 25, 2019, Full University Curriculum Committee meeting

Sincerely,

John Maerz, Chair
University Curriculum Committee

cc: Interim Provost Libby V. Morris
Dr. Rahul Shrivastav

The University of Georgia

Dear A.P. Council,

April 10, 2018

The mathematics department would like to request a change to our AP credit policy.

Current Policy Our current policy is as follows:

BC Calculus Score of 4	BC Calculus Score of 5
MATH 1101 (0 credit hours)	MATH 1101 (0 credit hours)
MATH 1113 (0 credit hours)	MATH 1113 (0 credit hours)
MATH 2250 (4 credit hours)	MATH 2250 (4 credit hours)
	MATH 2260 (0 credit hours)*

* Students who score 5 on the BC calculus exam can receive 4 additional credit hours for MATH 2260 after successfully completing a subsequent math course (MATH 2270, 2500, 2700, 3000, 3300, or 3500) and petitioning the Associate Head of the Mathematics Department for credit.

Proposed Policy We would like to change this policy to:

BC Calculus Score of 4 or 5
MATH 1101 (0 credit hours)
MATH 1113 (0 credit hours)
MATH 2250 (4 credit hours)
MATH 2260 (4 credit hours)

That is, we would award credit hours for MATH 2260 immediately, rather than on completion of a subsequent course, and we would award these credit hours for scores of 4 or 5, rather than only for scores of 5.

Rationale

The Mathematics Department Curriculum Committee has recently reviewed our policy on advanced placement credit as part of a continuing project to overhaul our placement system. We think the proposed change is desirable for several reasons:

- The current system is unwieldy. Relatively few students seem to be aware that they can receive AP credit for MATH 2260, and the requests have to be processed by hand on an irregular basis. This leads to equity concerns– not all students may be receiving the credit they are eligible for simply because they do not request it.
- We are out of line with our peer institutions. 15 of our 16 designated peer institutions grant calculus II credit for a BC calculus score of 4 or higher. Only one (UC Davis) requires a score of 5, and they grant calculus II credit immediately. No peer institution requires the completion of a subsequent course for credit.
- We are overenrolled. The lower-division mathematics courses have seen steady increases in enrollment during the past few years, and dramatic rises in section counts (due to the small class initiative). It is inefficient for everyone to have students enrolled in courses for which they have already demonstrated that they know the material.
- The AP exams have improved. We have not reviewed our AP policy in at least a decade. However, the exams have made significant strides during that time period. The BC exam now covers almost everything in our standard MATH 2260 course.

Content Comparison

The content for the BC calculus exam and the MATH 2250-2260 course sequence are very well aligned. Both cover limits, derivatives, integrals and the fundamental theorem of calculus, and series, as well as some material on vectors. The curriculum for the Calculus I and II sequence is largely standardized across the nation. There is nothing unusual about our curriculum at UGA, so the BC Calculus exam has been extensively studied as an equivalent qualification to our courses. The math department also feels confident that the exam is given at an appropriate level of rigor for our students.

Peer Comparison

Here are the corresponding policies at our peer institutions for BC calculus AP scores:

Peer Institution	BC Score	Calculus I	Calculus II	Total Hours
Virginia Tech	4	Yes	Yes	8
Michigan State	3	Yes	Yes	7
University of Kentucky	3	Yes	Yes	8
Iowa State University	4	Yes	Yes	8
University of Arizona	4	Yes	Yes	6
University of Iowa	4	Yes	Yes	8
University of Indiana-Bloomington	4	Yes	Yes	8
University of Maryland College Park	4	Yes	Yes	8
North Carolina State University	4	Yes	Yes	8
Ohio State University	3	Yes	Yes	10
University of Missouri	3	Yes	Yes	15
University of California at Davis	5	Yes	Yes	8
Purdue	4	Yes	Yes	8
Stony Brook University	4	Yes	Yes	8
University of Florida	4	Yes	Yes	8

The data reveal that our current practice awards less credit than any of our 16 peer institutions; that is, we are an outlier. The new policy would be comparable to the policies at 10 of our peer institutions, and less generous than policies at 5 of the 6 others.

Student Impact

The MATH 2260 course is a large course (we ran 39 sections of MATH 2260 during the 2016-2017 academic year), enrolling roughly 1200 students per year. Data from ARGOS seems to indicate that in Fall of 2017, 291 students exempted MATH 2260 on the basis of receiving a 5 on the BC calculus exam. A different dataset on ARGOS suggests that roughly an additional 100 students (per year) would qualify for a MATH 2260 exemption under the new policy (these are students with a 4 on the BC calculus exam). This would potentially decrease the number of sections of MATH 2260 by roughly 3 per year. In context, this impact is positive, but relatively small.

There are 36 undergraduate majors which require or recommend MATH 2260:

Agribusiness - B.S.A.
Agricultural and Applied Economics - B.S.A.
Agricultural Engineering - B.S.A.E.
Atmospheric Sciences - B.S.
Biochemical Engineering - B.S.Bch.E.
Biochemistry and Molecular Biology - B.S.
Biological Engineering - B.S.B.E.
Biology - B.S.
Biology/Science Education - B.S., B.S.Ed.
Civil Engineering - B.S.C.E.
Computer Science - B.S.
Computer Systems Engineering - B.S.C.S.E.
Ecology - B.S.
Economics - A.B.
Electrical and Electronics Engr. - B.S.E.E.
Entomology - B.S.E.S.
Environmental Econ. and Mgmt - B.S.E.S.
Environmental Engineering - B.S.Env.E.
Exercise and Sport Science - B.S.Ed.
Food Industry Marketing and Admin. - B.S.A.
Genetics - B.S.
Geography - B.S.
Geology - B.S.
Health Promotion - B.S.H.P.
International Affairs - A.B.
Mathematics - B.S.
Mathematics Education - B.S.Ed.
Mathematics/Mathematics Ed. - B.S., B.S.Ed.
Mechanical Engineering - B.S.M.E.
Microbiology (also offered at Griffin) - B.S.
Pharmaceutical Sciences - B.S.
Physics - B.S.
Physics and Astronomy - B.S.
Plant Biology - B.S.
Political Science - A.B.
Science Education - B.S.Ed.
Statistics - B.S.

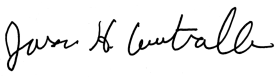
Student Progression and Graduation

It is clear that the proposed policy will lead to faster student progression and increased graduation rates, as we are removing barriers from the students' paths. In principle, this should also make it easier for students to pursue STEM degrees and dual-degrees. It is hard to say exactly how large the effect will be, but it will not be huge. We estimate that no more than about 200 additional students would receive MATH 2260 credit by AP score per year (combining our estimates for the number of students with a 4 on the exam and an estimate for the number of students who currently qualify for credit on request, but don't request it).

Resources Needed

None. The proposed, simpler policy will free up resources by reducing demand for MATH 2260 and reducing the administrative burden entailed by our current program.

Best wishes,



Jason Cantarella
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Franklin College of Arts and Sciences
Department of Mathematics

January 24, 2019

Curriculum Committee
University Council
University of Georgia
Athens, GA 30602

Dear Curriculum Committee:

We understand that the Mathematics Department's proposal to change AP Calculus credit was tabled at your last meeting because committee members asked for more evidence that students with a score of 4 on the BC exam had mastered material from MATH 2260 and could be successful in MATH 2500 or MATH 2270. Although we strongly feel that the information already provided showing that it is standard practice among our peer institutions to grant Calculus II credit for a score of 4 is strong evidence that these students are prepared for success in Calculus III, we would like to now present additional evidence in the form of student performance at UGA.

The included spreadsheet shows grades for students in Calculus I (MATH 2250), Calculus II (MATH 2260 or 2310H) and Calculus III (MATH 2270 or 2500). You will see that students with a score of 4 on the BC exam who take MATH 2260 strongly outperform other students in the class with more than half of them earning an A or A-. Interestingly, only about one third of these students go on to take 2270 or 2500 in the spring, but those that do so are also quite successful. We believe this to be additional strong evidence that many of these students are ready to go directly into 2270 or 2500.

Although these numbers are small at present, it is likely that, as we continue to attract better and better students interested in the STEM fields, we will see increases in the number of students arriving with a score of 4 on the BC exam. It would be unnecessarily slowing these students' progress to insist that they repeat Calculus II if they feel comfortable moving on. Of course we intend to monitor the success of

these students if placed into Calculus III and will be sure to revisit our policy if these students fail to perform well.

Sincerely,

William Graham
Department Head and Professor of Mathematics

	N	A	A-	B+	B	B-	C+	C	C-	D	F	W	%DFW
BC4, Fall 17													
2250	9	6	1	1	0	0	1	0	0	0	0	0	0
2260	61	27	7	6	10	2	0	1	0	4	2	2	13
2310H	4	2	0	1	1	0	0	0	0	0	0	0	0
BC5, Fall 17													
2260	11	5	2	0	1	0	1	1	0	0	0	1	9
2270	40	22	3	6	1	1	4	3	0	0	0	0	0
2500	48	23	6	2	6	3	0	2	0	3	1	2	12.5
2310H	2	2	0	0	0	0	0	0	0	0	0	0	0
BC4, Spring 18													
2250	3	3	0	0	0	0	0	0	0	0	0	0	0
2260	16	10	0	0	2	3	0	1	0	0	0	0	0
2270	8	2	3	0	2	0	1	0	0	0	0	0	0
2500	14	4	3	3	2	1	0	0	0	1	0	0	7
BC5, Spring 18													
2250	2	1	0	0	0	0	0	0	0	0	1	0	50
2260	2	0	1	0	0	0	1	0	0	0	0	0	0
2270	21	11	2	2	2	1	0	1	0	0	1	1	9.5
2500	13	3	3	2	2	0	1	1	0	0	0	1	7.7
Overall, Fall 17													
2250	999	244	92	104	147	63	39	72	27	53	27	131	21.12
2260	556	119	41	33	70	33	24	39	23	36	26	112	31.29
2310H	23	9	2	2	3	2	2	0	0	1	0	2	13
2270	166	51	16	15	8	14	9	12	4	7	3	27	22.29
2500	332	54	25	24	54	27	31	51	7	11	18	30	17.77
Overall, Spring 18													
2260	561	114	36	46	105	40	28	48	22	29	25	68	21.7
2270	118	26	13	11	21	6	8	14	2	3	3	11	14.4
2500	232	40	18	19	32	18	18	26	8	22	16	15	22.8